TIMING AND CONTROLS ON LATE PALEOZOIC TECTONISM AND SYNOROGENIC SEDIMENTATION, BURSUM FORMATION, SACRAMENTO MOUNTAINS, NEW MEXICO, USA

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ABSTRACT

Defining the role of Ancestral Rocky Mountain (ARM) tectonics on basin evolution and infill is critical for hydrocarbon exploration and development in the Permian and Orogrande basins, yet the timing and controls of late Paleozoic ARM deformation remain poorly constrained. We document these relationships in the Pennsylvanian–Permian Bursum Fm., which preserves a continuous record of deposition synchronous with uplift of the adjacent ARM fold-thrust belt and Pedernal massif. Sedimentation took place between two end-member depositional systems: 1) a shallowly dipping, physically-modified carbonate ramp, and 2) an alluvial fan-deltaic siliciclastic system. The newly developed high-resolution stratigraphic framework from nine measured sections averaging 94 m shows that the Bursum Fm. transitions from open-marine ammonite-bearing shales at the base, to terrestrial fanglomerates at the top. Provenance analysis indicates that alluvial fans were localized along active faults, and clasts were sourced from uplifted late Paleozoic strata and Pedernal metamorphic basement. Paleocurrent data reveals key paleotopographic features that influenced facies distribution, with a change to multimodal patterns identified in offshore littoral sand bodies. Growth strata, soft-sediment deformation, fault-slip analysis, and unconformable contact relationships with the underlying Pennsylvanian Holder Fm. and overlying Permian Abo Fm. show that deposition occurred contemporaneously with compressional and right-lateral oblique slip along the fold-thrust system. These results and constant-length cross section restoration show that the Fresnal Fault and La Luz Anticline experienced a resurgent phase of ARM tectonism that peaked in the latest Virgilian (~301 Ma), and rapidly waned into the earliest Wolfcampian (~296 Ma). These findings constrain the poorly understood timing of the end of the ARM, and provide insight into a key gap in the stratigraphic record of southern New Mexico and west Texas.

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